

Stream List						
Stream No.	Temperature	Pressure	Flowrate	Energy	Description	
[ ]	[K]	[Bara]	[kg/18months]	[MJ]	[ ]	

1					1 Cabin Air Feed to Process	
2					1 Compressed Cabin Air	
3					1 Cold Utility Feed for 2-E-101	
4					1 Cold Utility Return for 2-E-101	
5					1 Adsorption Bed 2-A-102A Feed	
6					1 Dried Air	
7					1 Compressed Dried Air	
8					1 Cold Utility Feed for 2-E-102	
9					1 Cold Utility Return for 2-E-101	
10					1 Adsorption Bed 2-A-102A Feed	
11					1 Adsorption Bed 2-A-102A Air Product (Less CO2)	
12					1 Compressed Air Product (Less CO2)	
13					1 Hot Utility Feed for 2-E-103	
14					1 Hot Utility return for 2-E-103	
15					1 Adsorption Bed 2-A-101B Feed	
16					1 Adsorption Bed 2-A-101B Product	
17					1 Cold Utility Feed for 2-E-104	
18					1 Cold Utility Return for 2-E-104	
19					1 Cabin Air Return Stream (Less CO2)	
20					1 Adsorbed CO2 Product from 2-A-102B	
21					1 Compressed CO2	
22					1 Radiative Heat Loss (Energy)	
23					1 Cooled CO2 Feed to 2-D-101	
24					1 CO2 Process Feed	
25					1 Expanded CO2 Process Feed	
26					1 Sabatier Reactor Mixed Feed	
27					1 Electrical Input to 2-E-201	
28					1 Electrical Output to 2-E-201	
29					1 Pre-Heated Sabatier Reactor Mixed Feed	
30					1 Cold Utility Feed for 2-R-201	
31					2 Cold Utility Return for 2-R-201	
32					1 2-R-201 Product Stream	
33					1 Cold Utility Feed for 2-E-202	
34					1 Cold Utility Return for 2-E-203	
35					1 Dried Gas Product from 2-E-202	
36					1 Compressed Dried Gas Product from 2-E-202	
37					1 Cold Utility Feed for 2-E-203	
38					1 Cold Utility Return from 2-E-203	
39					1 Cooled Gas Feed to 2-A-201A	
40					1 Waste Gas from 2-A-201A	
41					1 Adsorbed hydrogen from 2-A-201B	
42					1 Expanded hydrogen from 2-A-201B	
43					1 Mixed hydrogen recycle	
44					1 Hydrogen Process Feed	
45					1 Liquid Water Product from 2-E-202	
46					1 Pressurised water from 2-E-202	
47					1 Cold Utility Feed to 2-E-204	
48					1 Cold Utility Return from 2-E-203	
49					1 Cooled Water Feed to 2-TK-201	
50					1 Shuttle Resupply Water Feed	
51					1 Water Outlet from 2-TK-201	
52					1 Pressurised Water Feed to 2-R-301	
53					1 Hydrogen Product from 2-R-301	
54					1 Electrolyte Recycle to 2-R-301 (H2)	
55					1 Combined Electrolyte Recycle to 2-R-301 (H2)	
56					1 Cold Utility Feed to 2-E-301	
57					1 Cold Utility Return from 2-E-301	
58					1 Cooled Combined Electrolyte Recycle to 2-R-301 (H2)	
59					1 Wet Hydrogen Product Gas	
60					1 Cold Utility Feed to 2-E-302	
61					1 Cold Utility Return from 2-E-302	
62					1 Liquid Product from 2-E-302	
63					1 Dried Hydrogen Product from 2-E-302	
64					1 Expanded Hydrogen Recycle	
65					1 Wet Oxygen Product Gas	
66					1 Electrolyte Recycle to 2-R-301 (O2)	
67					1 Combined Electrolyte Recycle to 2-R-301 (O2)	
68					1 Cold Utility Feed to 2-E-303	
69					1 Cold Utility Return from 2-E-303	
70					1 Cooled Combined Electrolyte Recycle to 2-R-301 (O2)	
71					1 Wet Oxygen Product Gas	
72					1 Cold Utility Feed to 2-E-304	
73					1 Cold Utility Return from 2-E-304	
74					1 Liquid Product from 2-E-304	
75					1 Dried Oxygen Product from 2-E-304	
76					1 Expanded Oxygen Product	
77					1 Cold Utility Feed to 2-E-305	
78					1 Cold Utility Return from 2-E-305	
79					1 Oxygen Product Cabin Return	
80					1 Hydrogen Resupply Feed from Shuttle	
81					1 Compressed Hydrogen Resupply	
82					1 Martian Air Feed to 2-E-401	
83					1 Martian Air Return from 2-E-401	
84					1 Cooled Hydrogen Resupply to 2-D-401	
85					1 Hydrogen Make-up Stream from 2-D-401	

Equipment List			
Item Number	Description	Unit Operation	Equipment Type
2-A-101A/B	Water Removal Adsorption Bed	Gas/Gas Separation	Temperature Swing Adsorption Bed
2-A-102A/B	CO2 Removal Adsorption Bed	Gas/Gas Separation	Temperature Swing Adsorption Bed
2-A-201A/B	H2 Removal Adsorption Bed	Gas/Gas Separation	Pressure-Swing Adsorption Bed
2-C-101A/B	Cabin Air Compressor	Fluid Transfer	
2-C-102A/B	Dried Air Blower	Fluid Transfer	
2-C-103A/B	Vacuum Compressor For Air Evacuation	Fluid Transfer	
2-C-104A/B	Vacuum Compressor for CO2 Recovery	Fluid Transfer	
2-C-201A/B	Compressor For Hydrogen Recovery	Fluid Transfer	
2-C-401A/B	Hydrogen Storage Compressor	Fluid Transfer	Multi-Stage Reciprocating
2-D-101	CO2 Atmospheric Gas Storage	Gas Storage	Gas Storage Balloon
2-D-301	Hydrogen Knock-Out Drum	Gas/Liquid Separation	
2-D-302	Oxygen Knock-Out Drum	Gas/Liquid Separation	
2-D-401A/B/C	Bulk Hydrogen Storage Vessel	Gas Storage	Spherical Pressure Vessel
2-E-101	Air Feed Pre-Cooler	Heat Exchange	Shell and Tube
2-E-102	Dried Air Feed Cooler	Heat Exchange	Shell and Tube
2-E-103	Air Heater	Heat Exchange	Shell and Tube
2-E-104	Cabin Air Return Cooler	Heat Exchange	Shell and Tube
2-E-105	CO2 Gas Cooler	Heat Exchange	Single Pipe Radiation
2-E-201A/B	Sabatier Reactor Feed Heater	Heat Exchange	Internal Electrical Coil
2-E-202	Sabatier Reactor Product Condenser	Heat Exchange	
2-E-203	H2 Adsorption Bed Pre-Cooler	Heat Exchange	
2-E-204	Water Storage Feed Cooler	Heat Exchange	Double Pipe Exchanger
2-E-301	Electrolyte Recycle Cooler (H2)	Heat Exchange	
2-E-302	H2 Product Dryer	Heat Exchange	
2-E-303	Electrolyte Recycle Cooler (O2)	Heat Exchange	
2-E-304	O2 Product Dryer	Heat Exchange	
2-E-305	Oxygen Product Cooler	Heat Exchange	
2-E-401	Hydrogen Resupply Cooler	Heat Exchange	Air Cooler
2-M-201	Reactor Feed Mixer	Fluid Mixing	Agitated Vessel
2-P-201A/B	Water Storage Feed Pump	Fluid Transfer	
2-P-301A/B	Electrolysis Reactor Feed Pump	Fluid Transfer	
2-R-301A/B	Sabatier Reactor	Chemical Reaction	Packed Bed Reactor
2-R-301	Electrolysis Reactor	Electrochemical Reaction	
2-TK-201	Electrolysis Feed Water Storage Tank	Liquid Storage	Fixed Roof Tank

Valve List		
Displayed Text	Description	Valve Class
CV-A-1		Control Valve
CV-A-2		Control Valve
CV-A-3		Control Valve
CV-A-4		Control Valve
CV-A-5		Control Valve
CV-A-6		Control Valve
CV-A-7		Control Valve
CV-A-8		Control Valve
CV-A-9		Control Valve
CV-A-10		Control Valve
CV-A-11		Control Valve
CV-A-12		Control Valve
CV-A-13		Control Valve
CV-A-14		Control Valve
CV-A-15		Control Valve
CV-A-16		Control Valve
CV-A-17		Control Valve
CV-A-18		Control Valve
CV-A-19		Control Valve
CV-A-20		Control Valve
CV-A-21		Control Valve
CV-A-22		Control Valve
EV-A-1		Expansion Valve
EV-A-2		Expansion Valve
EV-A-3		Expansion Valve
EV-A-4		Expansion Valve
EV-A-5		Expansion Valve
EV-A-6		Expansion Valve

Process Control Scheme :-

Main Process Line :-

Auxiliary Process Line :-

Cold Utility Line :-

Hot Utility Line :-

Process Flow Diagram Line Colour Key

Auxiliary Process Fluid Line :-

Control Electrical Signal :-

Energy Stream :-

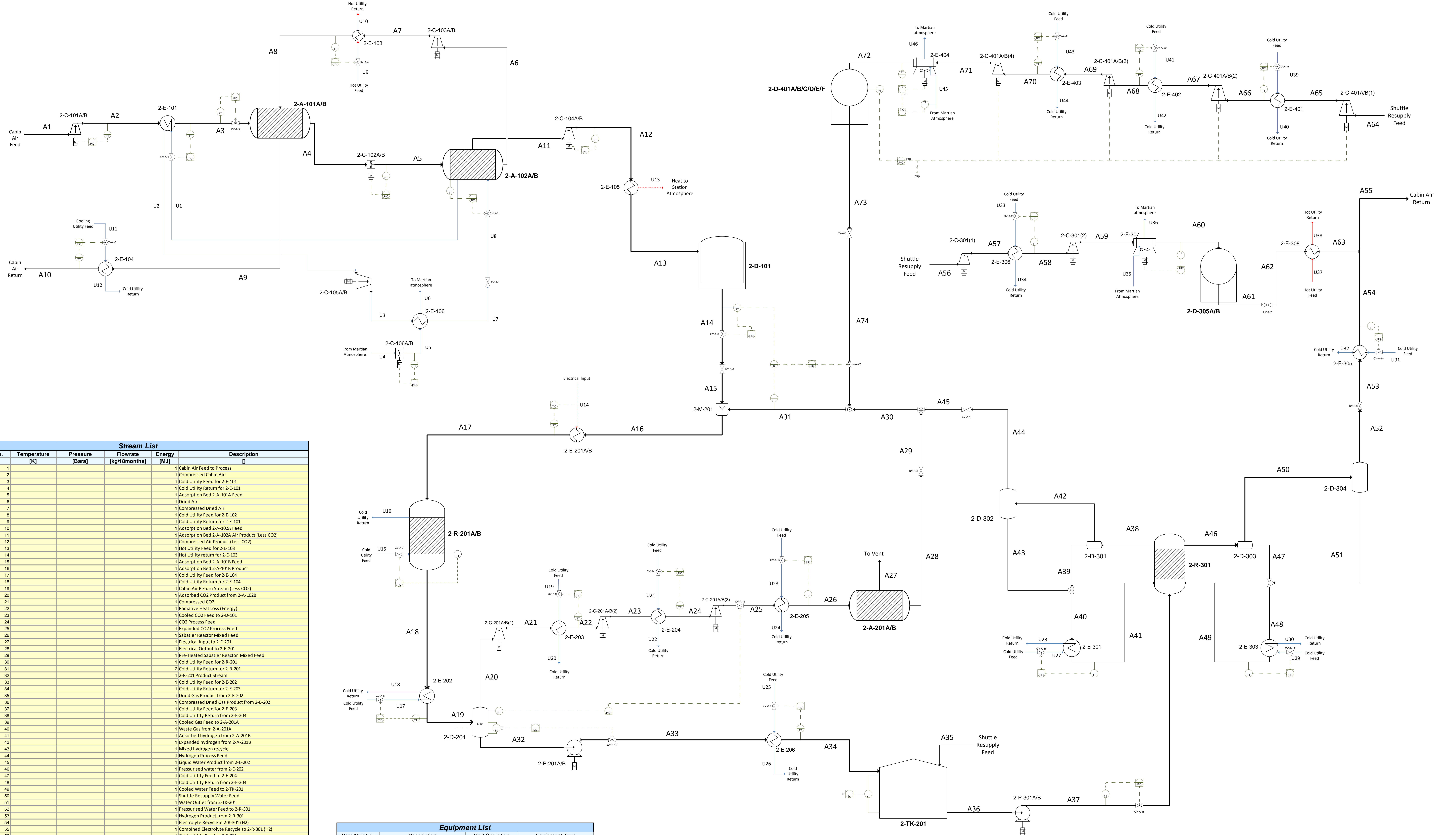
Process Flow Diagram Line Style Key

Main Process Fluid Line :-

Auxiliary Process Fluid Line :-

Control Electrical Signal :-

Energy Stream :-



# PROCESS FLOW DIAGRAM

Air Treatment Plant

University of  
Edinburgh

Edinburgh

COMPANY LOGO



DRAWING NO.

REV.

1